PATENT SPECIFICATION

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399,665

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PROVISIONAL SPECIFICATION.

Improvements in Rotary Gas Pumps.

We, G. & J. WEIR, LIMITED, of Holm Foundry, Cathcart, Glasgow, a British Company, and JAMES SIM, of the same address, a British Subject, do hereby declare the nature of this invention to be as follows:—

This invention relates to gas pumps of the rotary liquid-ring type wherein gas or air and vapour is or are drawn into and discharged from the intervane spaces of a rotating impeller, said spaces being alternately emptied of, and filled with, liquid in each revolution of the impeller, whereby to set up pumping action which withdraws the gas or air and vapour from the vessel being exhausted and delivers the same to atmosphere. In contradistinction with normal rotary or centrifugal pumps, the casing of the pump forming the subject of this invention is arranged to rotate.

A liquid-ring gas pump constructed in accordance with the present invention comprises a rotary casing penetrated axially by a fixed divided pipe presenting inlet and outlet passages ported at their inner ends for communication with the inner periphery of an impeller housed within said casing and rotatable therewith, and a fixed disc located within said casing and forming one side wall of the impeller and presenting a segmental flange which shrouds part of the periphery of the impeller, said disc being provided with a tubular scoop having an inlet located at the periphery of the casing and facing against the direction of rotation thereof and having an outlet directed into the inner periphery of the impeller on the shrouded side thereof. The construction is such that, in the rotation of the casing and impeller, liquid within the casing is constrained centrifugally to rotate in the form of a ring lining said casing, and that liquid from the ring entering the scoop and delivered to the peripherally shrouded side of the impeller displaces gas or air and vapour entrained in said side to the pump outlet and is expelled centrifugally from the impeller when it passes clear of the shrouding, whereby suction is set up in the inlet passage.

A practical construction comprises a cylindrical pump casing having an integral end wall presenting a hollow trunnion for penetration by the pipe, and an opposed end wall in the form of a cover detachably secured to the casing and presenting on its inner side a vaned impeller walled on the side remote from the cover by the disc.

The disc is unitary with a central boss surrounding and fixed to the inner end of the pipe and ported to permit communication between the ported inner end of the pipe and the inner periphery of the impeller.

The pipe is provided with a diametral partition dividing the pipe into inlet and outlet passages which merge into separate inlet and outlet branches on the outer end of the pipe. At its inner end the pipe is provided with diametrally opposed inlet and outlet ports located on opposite sides of the partition; the pipe is, further, provided with an imperforate inner end wall. The said inlet and outlet ports register with ports in the fixed boss affording communication with the inner periphery of the impeller, the inlet ports communicating with the unshrouded side of the impeller and the outlet ports communicating with the shrouded side of the impeller.

The tubular scoop is preferably of spiral form and communicates with the inner periphery of the impeller by way of an elongated arcuate slot in the disc close to the boss.

The hollow trunnion may be journalled in antifriction bearings located within a housing carried by spider arms supported from the fixed structure of a pump-driving motor.

Conveniently, the pump and motor are arranged for rotation on a vertical axis, the pump surmounting the motor and the armature shaft of the latter being coupled to the pump casing cover. As will readily be understood, in initiating operation of the pump it is essential to prime the pump with liquid.

The boss of the disc preferably enters a central socket in the casing cover, a bearing being provided in the cover for

a centring journal unitary with the boss.

The diameter of the disc may be substantially equal to or greater than the diameter of the impeller, in which latter case the disc will overhang the impeller shrouding flange.

The shrouding flange may extend around one half of the periphery of the impeller.

Dated the 15th day of November, 1932.

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Chartered Patent Agent.

COMPLETE SPECIFICATION.

Improvements in Rotary Gas Pumps.

We, G. & J. WEIR, LIMITED, of Holm Foundry, Cathcart, Glasgow, a British Company, and JAMES SIM, of the same address, a British Subject, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to gas pumps of the liquid-ring type comprising a rotary impeller having intervane cells which are alternately emptied of, and filled with, liquid in each rotation of the impeller, whereby to set up pumping action which withdraws the gas or air and vapour from a vessel to be exhausted and delivers the same to atmosphere. In contradistinction with normal rotary or centrifugal pumps, in the pump forming the subject of this invention the casing rotates with the impeller.

A liquid-ring gas pump constructed in accordance with the invention comprises a rotary pump casing, a vaned impeller mounted within said casing and rotatable therewith, means shrouding part of the periphery of the impeller, a tubular scoop within the casing, having an inlet for liquid located at or near the periphery of the casing and an outlet directed into the shrouded side of the impeller, and a pipe structure extending axially of the casing and provided with gas inlet and outlet ports communicating with the impeller eye.

The operation is such that, in the rotation of the casing and impeller, liquid within the casing is constrained centrifugally to rotate in the form of a ring lining the casing, and that liquid entering the scoop from the ring and delivered to the peripherally shrouded side of the impeller displaces gas or air and vapour from the intervane cells of the impeller at that side to the pump outlet, and is expelled centrifugally from the impeller when it passes clear of the shrouding, whereby suction is set up in the pump inlet.

A practical construction comprises a cylindrical pump casing having an integral end wall to which the impeller is attached, and an opposed detachable end wall presenting a hollow trunnion penetrated by a fixed pipe and journalled in an end member of a stationary casing surrounding the pump casing and open to the atmosphere. The scoop is unitary with a slotted disc provided with a flange that shrouds part of the impeller periphery. The disc is provided with a central boss surrounding and fixed to the inner end of the pipe and ported in the plane of rotation of the impeller in correspondence with inlet and outlet ports in the pipe.

The inner end portion of the pipe is provided with a diametral partition separating inlet and outlet passages, the inlet passage being continuous with the outer end of the pipe forming the inlet branch, and the outlet passage merging into an outlet port communicating with the interior of the pump casing, the pump casing being provided with an outlet port to atmosphere located within the inner periphery of the liquid ring.

The tubular scoop is in the form of a spiral starting from the slot in the disc which is so disposed that intervane cells of the impeller passing the slot are progressively filled with liquid radially inwards of the impeller, whereby the gas or air in said cells is progressively compressed until the cells come into register with the outlet port.

Conveniently, the pump and a pump-driving motor are arranged for rotation on a vertical axis, the pump surmounting the motor and the armature shaft of the latter being coupled to the integral end wall of the pump casing.

A liquid-ring gas pump constructed in accordance with the present invention is illustrated in the accompanying drawings, in which Fig. 1 is a vertical section, and Figs. 2 and 3 are horizontal sections on the lines 2—2 and 3—3, respectively, of Fig. 1.

The liquid-ring gas pump shown comprises a cylindrical pump casing 1 mounted for rotation about a vertical axis and penetrated axially by a fixed

pipe 2 presenting at its inner end inlet and outlet passages 3, 4, respectively, provided at their inner ends with diametrally opposed ports 5, 6, respectively, located in the plane of rotation of a vaned impeller 7. A fixed disc 8 located within the casing 1 and forming a covering wall for the impeller 7 is provided with a depending arcuate flange 9 which extends over more than a semi-circumference so as partially to shroud the periphery of the impeller. Uprising from the disc 8 is a tubular scoop 10 of spiral form having an inlet 11 located at the periphery of the casing 1 and facing against the direction of rotation thereof indicated by the arrow A; the outlet 12 of the scoop is constituted by a spiral slot in the disc 8 at the shrouded side of the impeller 7.

The pump casing 1 has an integral bottom wall 13 to which the impeller 7 is attached and from which depends a central boss 14 coupled to the armature shaft 15 of a driving motor disposed within a casing 16 surmounted by the pump. A cover 17 detachably fitted to the casing 1 presents a hollow trunnion 18 penetrated by the pipe 2 and journalled in a roller bearing 19 mounted in a cover 20 applied to a stationary casing 21 surrounding the pump casing 1 and open to the atmosphere.

The disc 8 is unitary with a central boss 22 surrounding and fixed to the inner end of the pipe 2 and provided with ports 5^1, 6^1 registering, respectively, with the ports 5, 6. A downward extension 23 of the boss 22 is centered in a bearing 24 fitted into the boss 14.

The inner end portion of the pipe 2 is provided with a diametral partition 25 separating the inlet and outlet passages 3, 4, the passage 3 being continuous with the upper portion of the pipe which merges at its upper end into an inlet branch 26. The outlet passage 4 communicates with the interior of the casing 21, i.e., with the atmosphere, by way of ports 27, 28 formed, respectively, in the pipe 2 and in the pump casing cover 17, the port 28 being located within the inner periphery of the liquid ring.

As will be evident, the inlet passage 3 communicates by way of the ports 5, 5^1 with the unshrouded side of the impeller 7 and the outlet passage 4 communicates by way of the ports 6, 6^1 with the shrouded side of the impeller 7.

The pipe 2 is integral with a flange 29 bolted to the cover 20.

Make-up sealing liquid is supplied to the pump casing 1 through a branch 30 on the upper end of the pipe 2, the pump casing 1 being initially primed with sealing liquid by way of a normally plugged orifice 30^1 in the upper end of the pipe 2. Excess sealing liquid is entrained by the discharged gas and discharged therewith through the port 28, being trapped in an annular gutter 31 within the casing 21 whence it is drained away by way of a drain connection 32.

It will readily be understood that, in the rotation of the casing 1 and impeller 7, liquid within the casing 1 is constrained centrifugally to rotate in the form of a ring lining the casing as shown by the vertical dotted lines in Fig. 1, and that liquid entering the scoop 10 from the ring and delivered to the peripherally shrouded side of the impeller 7 displaces gas or air and vapour from the intervane cells at that side to the pump outlet, and is expelled centrifugally from the impeller 7 when it passes clear of the shrouding 9, whereby suction is set up in the pump inlet.

It will be seen that the shroud flange 9 and the ported pipe 2 function, in effect, as valves which open and close the intervane cells in the rotation of the impeller. Liquid in those cells unshrouded by the flange 9 recedes centrifugally from the centre outwards and thus exercises suction effect on the port 5, passage 3, and inlet 26. As the cells pass within the confines of the shroud flange 9, they receive liquid from the scoop 10 through the spiral port 12 whereby the gas within the cells is compressed towards the centre of the impeller and finally discharged through the port 6, passage 4, and ports 27, 28, to atmosphere. As will be evident, the arrangement is such that the impeller cells are filled with and emptied of liquid in each rotation of the impeller.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A liquid-ring gas pump comprising a rotary pump casing, a vaned impeller mounted within said casing and rotatable therewith, means shrouding part of the periphery of the impeller, a tubular scoop within the casing, having an inlet for liquid located at or near the periphery of the casing and an outlet directed into the shrouded side of the impeller, and a pipe structure extending axially of the casing and provided with gas inlet and outlet ports communicating with the impeller eye.

2. A liquid-ring gas pump according to claim 1 in which the inner end portion of the pipe structure is provided with an internal partition defining an inlet passage and an outlet passage, the inlet

passage being continuous with the outer end portion of the pipe and the outlet passage merging into an outlet port communicating with the interior of the pump casing, the pump casing being provided with an outlet port to atmosphere located within the inner periphery of the liquid-ring.

3. A liquid-ring gas pump according to claim 1 in which the means for shrouding part of the periphery of the impeller is constituted by a flange unitary with a slotted disc which carries the scoop.

4. A liquid-ring gas pump according to claim 3 in which the slot in the disc forming the scoop outlet is so disposed that the intervane cells of the impeller passing said slot are progressively filled with liquid radially inwards.

5. A liquid-ring gas pump according to claim 1 in which one end wall of the pump casing is coupled to a driving shaft and the other end wall presents a hollow trunnion penetrated by the pipe structure and journalled in an end member of a stationary outer casing open to atmosphere.

6. A liquid-ring gas pump according to claim 5 in which the stationary outer casing is formed internally with an annular gutter adapted to receive excess sealing liquid discharged from the pump casing and fitted with a drain outlet.

7. A liquid-ring gas pump according to claim 3 in which the disc is unitary with a ported boss attached to the inner end of the pipe structure and presenting a journal extension centred in a bearing mounted in the adjacent end wall of the pump casing.

8. A liquid-ring gas pump constructed and arranged for operation substantially as hereindescribed with reference to the accompanying drawings.

Dated the 12th day of July, 1933.

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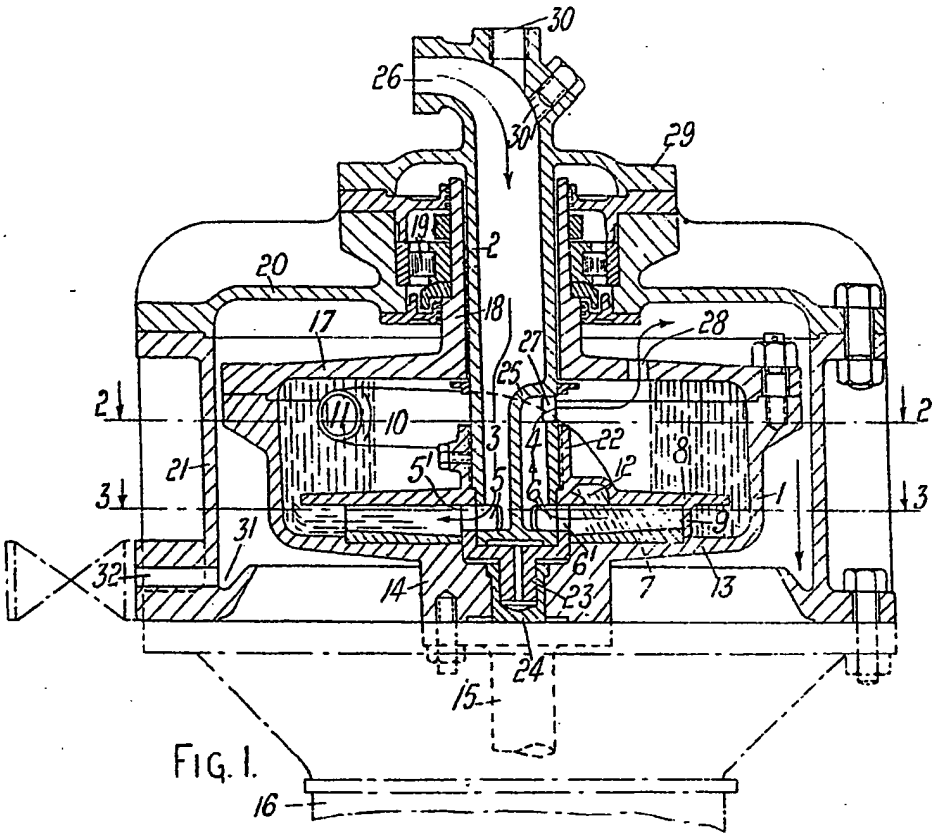

FIG. 1.

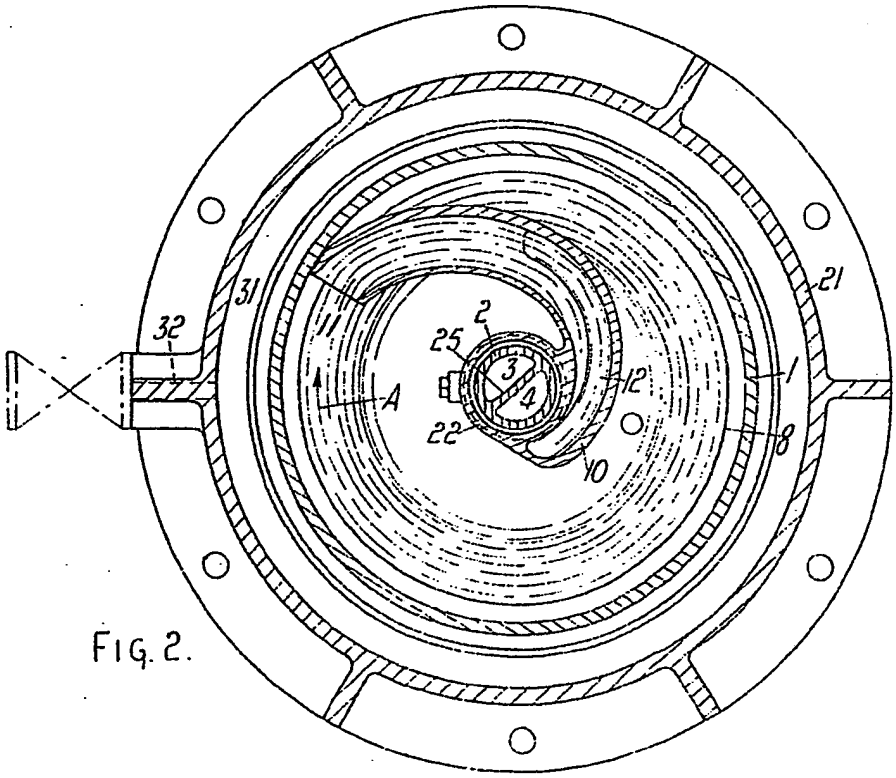

FIG. 2.

2

3

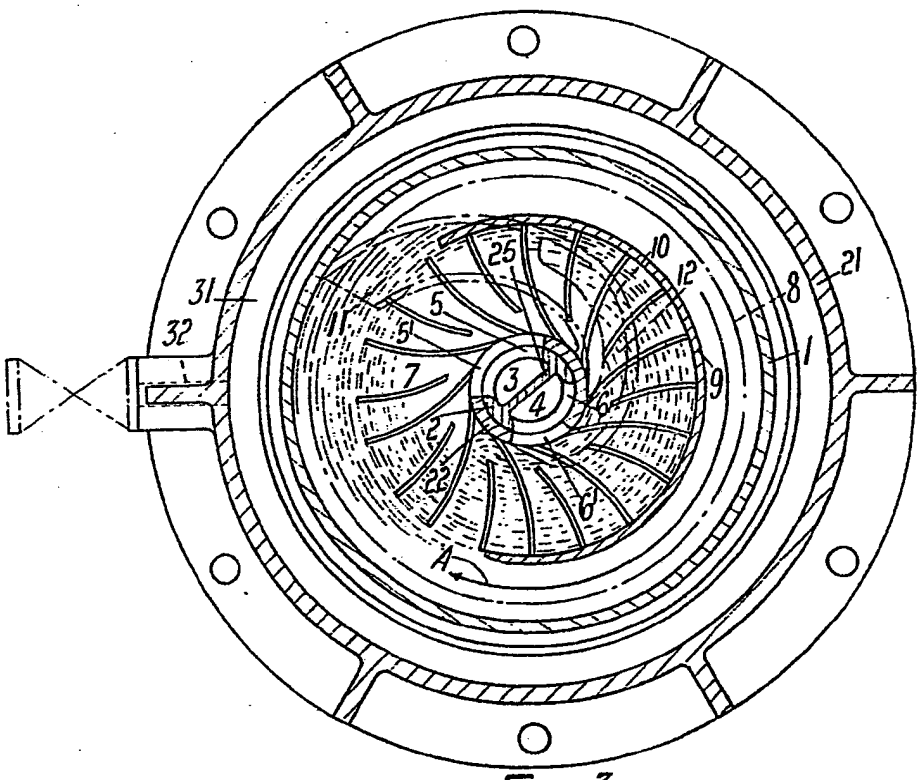

FIG. 3.

Malby & Sons, Photo-Litho.

399,665 COMPLETE SPECIFICATION

SHEET 1

2 SHEETS
SHEET 2

[This Drawing is a reproduction of the Original on a reduced scale.]

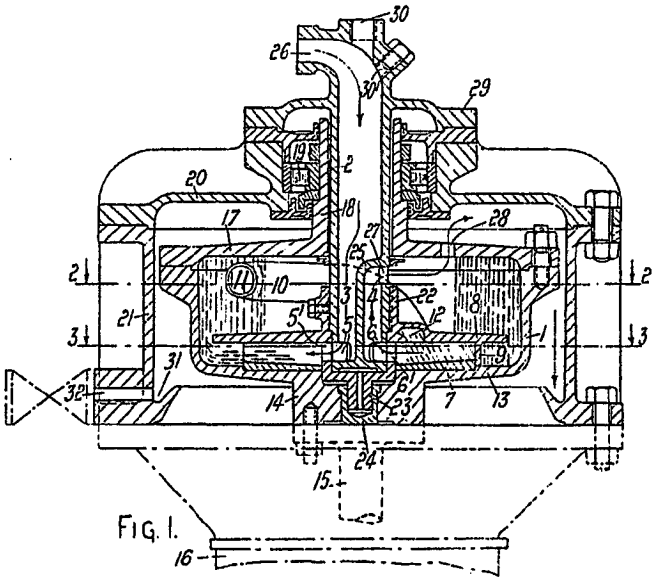

FIG. 1.

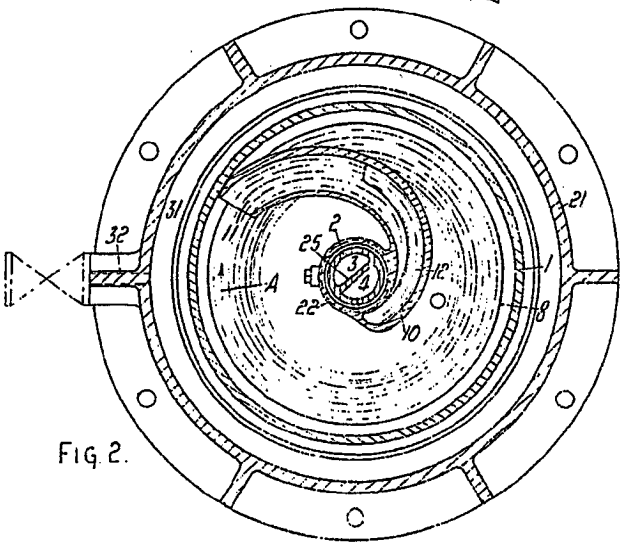

FIG. 2.

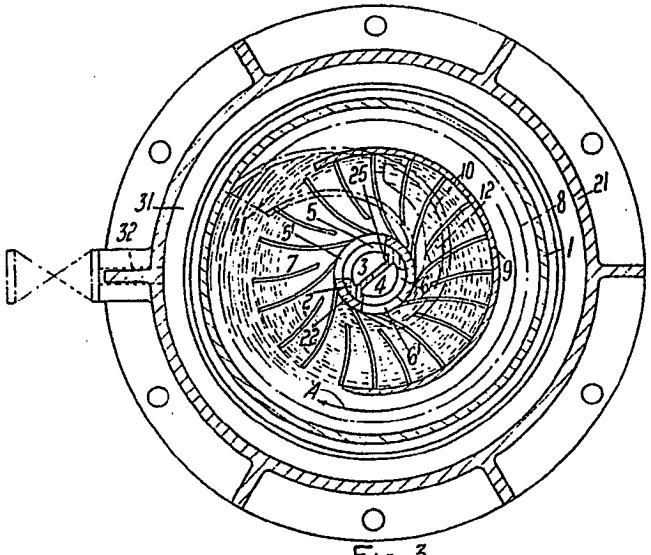

FIG. 3.

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